PROBLEM.

42. **Proposed by J. C. NAGLE, M. A., M. C. E., Professor of Civil Engineering, A. and M. College, College Station, Texas.**

Show that the volume included between the surface represented by the equation $z=e^{-(x^2+y^2)}$ and the xy plane equals the square of the area of the section made by the zx plane, the limits of x and y being plus and minus infinity.

MECHANICS.

Conducted by B.F.FINKEL, Kidder, Missouri. All contributions to this department should be sent to him.

SOLUTIONS OF PROBLEMS.

20. **Proposed by CHAS. E. MYERS, Canton, Ohio.**

A flexible cord of given length is suspended from two points whose co-ordinates are $(x, y,)$ and (x', y'). What must be the condition of the cord in order that it may hang in the arc of a circle?

Solution by WILLIAM HOOVER, A. M., Ph. D., Professor of Mathematics and Astronomy, Ohio University, Athens, Ohio.

Taking the lowest point for origin, and the horizontal and vertical lines through it for axes of x and y, and $s=a\varphi$......(1) for the intrinsic equation to the circle.

If $\pi=$ the constant horizontal component of tension at all points of the cord, the law of mass as given by Theoretical Mechanics is

$m=\frac{\pi}{g}\frac{d^2y}{dx^2}\Big\backslash\frac{ds}{dx}$....(2). We have $\frac{dy}{dx}=\tan\varphi$, $\frac{dx}{ds}=\cos\varphi$, $\frac{ds}{d\phi}=a$, from (1);

$$\frac{d^2y}{dx^2}=\frac{1}{\cos^2\varphi}\frac{d\varphi}{dx}=\frac{1}{\cos^2\varphi}\frac{d\varphi}{ds}\frac{ds}{dx}=\frac{1}{a\cos^3\varphi}\text{......(3).}$$

Then (2) gives $m=\frac{\pi}{g}\frac{a}{a^2\cos^2\varphi}=\frac{\pi a}{(a-y)^2}$....(4), or the mass unit varies inversely as the square of the distance below the horizontal diameter.

Excellent solutions of this problem were also received from *G. B. M. ZERR, and F. P. MATZ.*

21. **Proposed by J. A. CALDERHEAD, Superintendent of Schools, Limaville, Ohio.**

Show that, in the wheel and axle, when a force P, acting at the circumference of the wheel, supports a weight Q upon the axle,

$$P.(R\mp\rho\sin\varepsilon)=Q(r\pm\rho\sin\varepsilon)\pm W\rho\sin\varepsilon,$$

where R, r, and ρ are the radii of the wheel, the axle, and their common axis respectively, and ε is the limiting angle of resistance.